METEOROLOGICAL OFFICE
125652
30 DEC 1977
LIBRARY

RESTRICTED CIRCULATION

This paper is not an official document; it is for information only and must not be quoted in any printed publications.

AGRICULTURAL MEMORANDUM NO 806

by J B Tyldesley

Forecasting Septoria in England and Wales II

A. The 1976 and 1977 forecasts

In Ag Mem. 801, some forecasting rules were suggested for Septoria, based on the number of days with 1 mm or more of rain in the second half of May, adjusted if necessary by the number of days with rain in the first half of June. The May information gave a preliminary forecast in terms of light, moderate or severe infection shortly before harvest. If the first half of June was dry, then the final forecast severity was reduced by one category, eg heavy became moderate. The rules were based on data for 1970 - 75, and it is of interest to see how they fared in the 2 subsequent years.

May 1976 was notably wet, and this continued into the first 2 or 3 days of June. Subsequently the month was dry and warm, and this proved to be the start of a most unusually hot and dry summer. The first forecast was for heavy or moderate infection in all regions. In most regions the dry weather in June caused the final forecast to be modified to moderate or light, but in Northern England there had been just too many rain days early in the month for this reduction to take effect. The final distribution of forecasts is given in table 1.

Table 1 Septoria forecasts 1976

Infection level	Regions
Light	SW, SE, E
Moderate	Wales, W Mid, E Mid
Heavy	Yorks/Lancs, N

FH2B

In fact, final infections were light everywhere.

The weather of 1977 was very different. The second half of May was generally dry, resulting in an unequivocal forecast of light infection for all regions. The second half of June was very wet, but since according to the proposed forecast rules the weather in this period only modifies the forecast if it is dry, no change was made. The disease survey indicated light infectionseverywhere, completely confirming the forecast.

Thus 1976 and 1977 were both light Septoria years, though with very different weather. 1977 was well within the range of "normal" experience, and disease was correctly forecast. 1976 brought a summer such as is unlikely to be experienced again for a hundred years or more, and which was greatly different from any year in the period 1970 - 75 from which the forecast scheme was devised. The partial failure of the method is therefore not surprising, but points the need for better understanding of the influence of weather on the development of disease through the season.

B. Studies on individual sites in the Northern Region

1. Introduction In Ag Mem 801, the number of rain days was estimated from 2 or 3 stations only in each region. It was questioned whether, bearing in mind the erratic nature of some summer rainfall, this small number of stations gave an adequate representation of regional rainfall. It was also thought that variations in disease incidence within regions might be to some extent explicable by differences in rainfall from place to place. To investigate these points, it was decided to make a trial study in the Northern Region.

2. Crop data Mr E W H Ford, plant pathologist at Newcastle, kindly supplied the detailed data for each farm surveyed in 1972 - 76. (For 1970 and 1971 this information was not readily available). The data included the grid reference of the farmstead (but not of the individual field), the variety grown, whether conventional or reduced cultivations were used in establishing the crop, fungicide used if any, and the previous cropping history. In fact reduced cultivations or fungicide application occurred only in a tiny minority of cases.

The National Institute of Agricultural Botany assesses cereal varieties for their resistance to disease on an eight-point scale, 8 indicating the highest resistance. The NIAB ratings for resistance to Septoria were taken from the current lists.

3. Rainfall data The grid reference of each farmstead was taken as being that of the crop, and submitted to the Bracknell computer, which produced printouts of daily rainfall data at the nearest available station. The median distance between disease survey site and rainfall station was 9 km. Days with 1 mm or more of rain were counted by half months, as in Ag Mem 801.

4. Analysis Each site was allocated a number, in the order of the original surveys. Then for each year, the sites were re-arranged in order of increasing disease resistance, and tabulated with the disease and rainfall data. Extracts are given in table 2 for 1972 (a high Septoria year) and in table 3 for 1976 (a low Septoria year). Rain days are given for mid-May to mid-June, the period which was found in Ag Mem 801 to be most useful for prediction.

Table 2 Rain days in the period 16 May - 15 June, and disease data, 1972

site no	rain days	variety resistance	% disease leaf 2
7	16	3	27
6	18	4	12
8	17	4	34
17	15	4	35
1	10	4	61
2	10	4	54
4	12	4	24
9	17	4	13
10	13	4	16
13	19	4	32
15	15	4	22
19	16	4	19
3	10	5	95
11	?	5	12
16	15	5	47

Table 3 Rain days in the period 16 May - 15 June and disease data, 1976

site no	rain days	variety resistance	% disease leaf 2
73	10	4	2
74	10	4	0
77	?	4	0.4
82	9	4	1.6
86	9	4	0.8
79	9	5	0.8
87	8	5	0
90	7	5	0
85	9	6	0
75	8	8	32.6
80	9	8	0
81	9	8	0
83	?	8	0
84	8	8	0
88	8	8	0
89	8	8	0

It soon became clear that the variability of disease at individual sites was much greater than that of rain days, and that disease, rain days and varietal susceptibility were not related in any obvious way. Thus in 1972 site 3 had one of the highest resistances and lowest rain day totals, but the disease level was 95%. In 1976 site 75 had 32.6% disease with a variety (Maris Huntsman) of maximum disease resistance and below average rain days, when no other site had as much as 2%. It was checked that this particular result was not due to a clerical error, but it was not possible to re-examine the plant material.

Since the disease data were so variable, it was decided to look at them in 2 broad groups of varietal susceptibility on the NIAB scale, 1 - 4 (low resistance) and 5 - 8 (high resistance).

Table 4 Annual average values of rain days in the period 16 May - 15 June and disease

L - low resistance varieties

H - high resistance varieties

Year	rain days L	rain days H	% disease leaf 2 L	% disease leaf 2 H	no of sites L	no of sites H
1972	14.8	12.5	29	51	12	3
73	7.7	7.8	34	21	9	7
74	6.7	6.1	8	7	3	14
75	5.0	4.4	3	1	2	17
76	9.5	8.5	1	3	5	11

Table 4 gives average information for the 2 groups. The following points emerge:-

a. The use of varieties officially described as resistant has increased through the period.

b. Average disease is sometimes higher in the "high resistance" group than in the other (though in some years one group was made up of only a few sites).

c. There is no indication that rain days are higher in the high resistance group, as would be the case if farmers in the high rainfall areas deliberately selected resistant varieties.

The overall correlations co-efficients between disease and NIAB resistance rating were calculated and are given in table 5, and are clearly not significantly different from zero.

Table 5 Correlations of disease and resistance rating at individual sites

Group	Correlation co-efficient	number of cases
High resistance	-0.17	52
Low resistance	0.14	31
All	-0.06	83

Thus it appeared that looking at variety at a site and rainfall nearby, was not helpful in predicting Septoria at that site. But it remained possible that using the individual rainfall sites would give a better representation of rain days in the wheat growing areas of the Northern Region, than the three stations used in Ag Mem 801. Correlations were therefore calculated between disease and rain days through the growing season in the manner of Ag Mem 801, but using individual sites grouped according to varietal susceptibility. The results are given in table 6, the third column being copied from Ag Mem 801 for comparison.

Table 6 Correlations of wet days with disease for the Northern Region.

1972 - 76 using individual sites, 1970 - 75 using regional averages
L - low resistance varieties H - high resistance varieties

	1972 - 76		1970 - 75
	L	H	
April	0.27	0.19	0.40
1st half May	0.24	0.32	0.98
2nd half May	0.56	0.19	0.62
2nd half May + 1st half June	0.53	0.82	0.62
1st half June	0.10	0.70	0.52
2nd half June	0.95	0.72	-0.14
July	0.47	0.42	0.45
August	0.41	0.38	-0.41

In viewing these results it should be noted that the work on individual sites had to exclude 2 years, 1970 and 1971, which showed a good relation between Septoria and rain days, and include another, 1976, which had quite an exceptional summer.

All that can be said is that there is general relation between disease and rainfall in the late May - early June period. There is much scatter and overall it cannot be said that using individual rainfall sites has any advantage.

Conclusions

It has been shown that neither the NIAB resistance rating, nor the rainfall in the neighbourhood, is helpful in predicting the incidence of Septoria at individual sites. Nor has the use of local rainfall in relation to local disease, assisted in sharpening the picture over the whole of the Northern Region. The outcome is therefore disappointing in terms of practically useful results. It has, however, been helpful in drawing attention to the strengths and weaknesses of the National Cereal Leaf Disease Survey. The survey is intended to give a national picture of the economic loss due to those diseases, in which aim it is successful. In general it also gives a useful idea of the differences between regions, though occasionally the regional averages may be distorted by a single strange result. Thus in 1976 the Northern Region returned the highest average incidence of Septoria in England and Wales. Reference to table 3 shows that this is almost entirely due to the assessment of 32.6% disease at site 75. But the survey was not intended to be looked at site by site and experience has shown that it is not productive so to do. This should be borne in mind when considering the use of the survey in the study of diseases other than Septoria.

C. Septoria development and temperature

It has been suggested that once a Septoria infection has become well established by wet weather in May and early June, its subsequent progress may be accelerated by warm weather in late June and July. In Ag Mem 802, a feature of the national table of correlations between wet days and disease which was puzzling at the time, was a tendency to negative correlations in July and August. It is now thought that the correct interpretation of this may be that wet days are on the whole cool days, and that cool late summer days reduce the development of the disease. It is proposed to test this idea by looking directly at the late summer temperature in relation to earlier wet periods.

Any comments or suggestions on this paper should be referred to the author.

Meteorological Office
MAFF
Windsor House
Cornwall Road
Harrogate HG1 2PW
North Yorkshire

November 1977